ESO 1204

INTERNATIONAL LINKAGES WITH U.S. AGRICULTURE

By

Leroy J. Hushak*

*Professor, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio August 1985

INTERNATIONAL LINKAGES WITH U.S. AGRICULTURE

Leroy J. Hushak

Introduction

This manuscript is a draft of the international linkages section of a primer on linkages between macro or monetary-fiscal policy (U.S. and World) and U.S. agriculture to be published by the U.S. Department of Agriculture. The two remaining sections are 1) monetary and fiscal policy linkages including the exchange rate and 2) monetary-fiscal policy linkages to U.S. production agriculture and U.S. demand for agricultural products. This section is shared in prepublication form to allow interested readers early access to the material.

With this brief introduction (to important topics not addressed here that are hopefully addressed in one of the other sections and to references to missing sections) this section of the primer addresses six important topics: 1) the basis for trade or why we export some commodities and import others, 2) policies constraining agricultural trade, 3) evolution of the international financial system, 4) export linkages, 5) import linkages, and finally 6) linkages to macro policy variables. Since the purpose of the primer is to teach about linkages or relationships, there is not a section which analyzes the policy implications deriving from these linkages.

INTERNATIONAL LINKAGES WITH U.S. AGRICULTURE

Basis for Trade

A country tends to consume those goods and services which yield the greatest satisfaction to its residents. This in turn implies that those goods and services which are produced yield the greatest return to its resource base, i.e., the physical, human, and natural resources present within the country. In a world where there is relatively free exchange of goods and services among countries, nearly all countries can increase their satisfaction by producing a different set of goods and services than they consume. In this section, three concepts are discussed: 1) comparative advantage, 2) excess demand/supply, and 3) comparative advantage of U.S. agriculture.

Comparative Advantage

With the opportunity to trade, a country maximizes its satisfaction by producing those goods and services which it can produce at relatively low costs, and exchanging some of those goods and services for other goods and services which it produces at relatively high costs. This incentive to produce those goods and services which can be produced at the relatively lowest costs is called the principle of comparative advantage.

This principle of comparative advantage does not imply that only the lowest cost countries produce a good or service. A principle of absolute advantage might imply that some countries produce no goods or services because they are not the lowest absolute cost producers of anything. The principle of comparative advantage implies that each country has a unique bundle of goods and services which it can produce and export even if it is not the lowest absolute cost producer of anything.

Excess Demand/Supply

If a country has an excess supply of a good or service at the world market price and exports part of its output, it probably has a comparative advantage in the production of that good or service. If a country has an excess demand for a good or service and imports part or all of its consumption, it probably does not have a comparative advantage for production.

Excess demand/supply curves are derived from the country demand and supply curves for the good or service. In Figures 1 and 2, illustrations of excess wheat supply or demand are shown for a country with an excess supply and an excess demand, respectively. The demand curve shows the quantity of wheat demanded (consumed) at each price of wheat; the supply curve shows the quantity of wheat supplied (produced) at each price of wheat. The demand curve is negatively sloped; at higher prices of wheat less wheat is consumed. The supply curve is positively sloped; at higher prices of wheat more wheat is produced. The price P_o is the price where quantity demanded equals quantity supplied, Q_o; the price P_w is the world or international price. Without trade, each country consumes Q_o at price P_o.

With trade, both countries have incentives to enter the international wheat market. In Figure 1, where P_w is greater than P_o the country enters the market as an exporter. At world price, P_w, quantity supplied increases from Q_o to Q_s while quantity demanded decreases from Q_o to Q_d. The balance, $Q_s - Q_d$, is exported. This balance is point Q_x on the excess supply curve. The excess supply curve is equal to the quantity supplied minus the quantity demanded at each price above P_o.

When P_o is greater than P_w, as in Figure 2, the country enters the international market as an importer. At world price, P_w, quantity demanded

Figure 1. Illustration of Excess Supply of Wheat

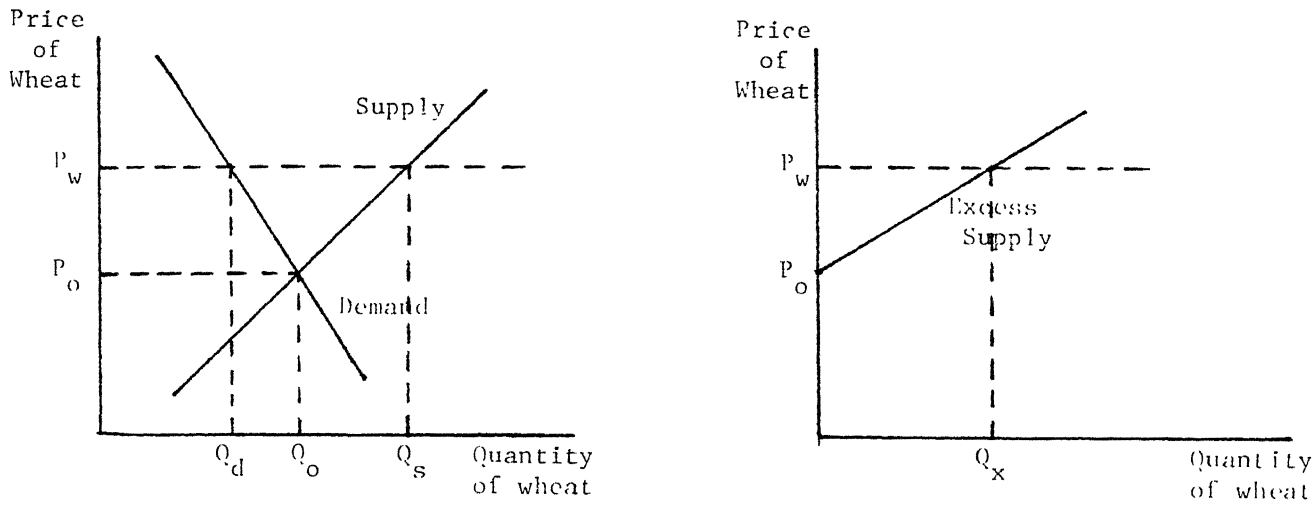
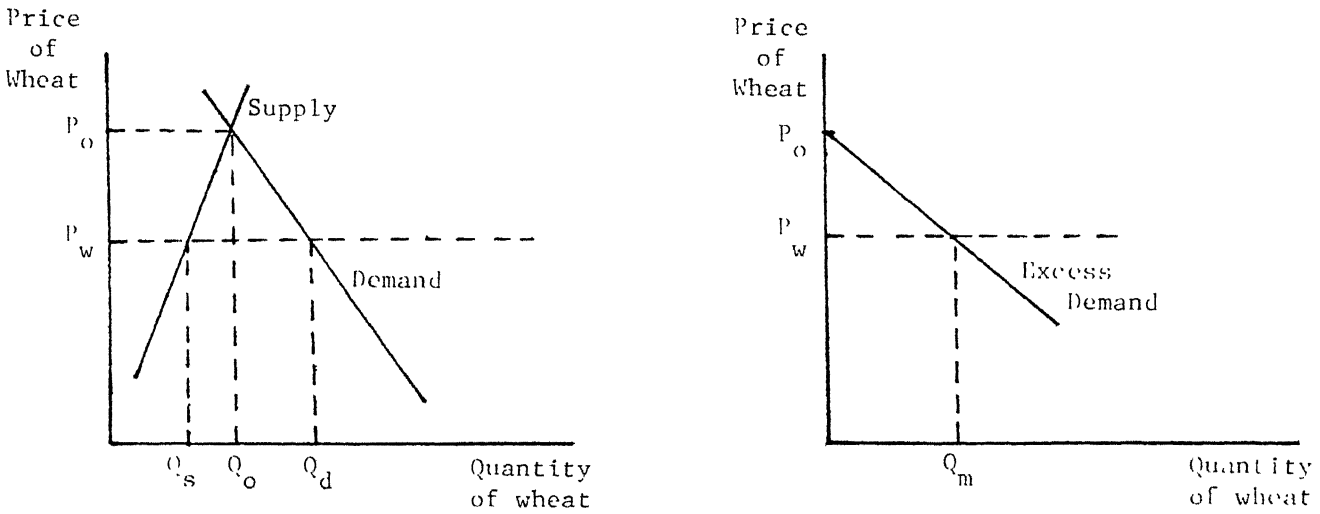


Figure 2. Illustration of Excess Demand for Wheat



increases from Q_o to Q_d while quantity supplied decreases to Q_s. The balance, $Q_d - Q_s$, is imported, and is point Q_m on the excess demand curve. The excess or import demand curve is equal to the quantity demanded minus the quantity supplied at each price below P_o.

Both countries potentially gain from trade. The country in Figure 1 is able to expand production of wheat, a commodity which it produces at relatively low cost, export wheat, and use the foreign exchange earnings to import other goods and services. Although wheat consumption decreases because wheat price increases, consumers in Figure 1 are able to increase consumption of other goods where the situation is as depicted in Figure 2.

The country in Figure 2 potentially gains through the ability to increase wheat consumption through imports at the world price. Wheat production decreases and the resources are released to produce goods and services where the country is in the situation depicted in Figure 1, i.e., where its costs are less than the world price and it can sell in export markets to earn foreign exchange.

Comparative Advantage of U.S. Agriculture

Based on U.S. exports and imports of agricultural products, agriculture in the U.S. probably has a comparative advantage in the production of feed grains (primarily corn), food grains (primarily wheat) and oilseeds (primarily soybeans). Since 1970, these three product groups have comprised 60 to 70 percent of U.S. agricultural exports with about equal shares from each group. Cotton, tobacco, and animal products are other important export products, but U.S. imports of animal products are approximately equal to exports. In addition to animal products, imports of agricultural products

are concentrated on tropical products such as coffee, cocoa, fruits, and vegetables.

Policies Constraining Agricultural Trade

To achieve national objectives, countries develop and implement many policies. Some of these policies are directed at the export or import of particular goods or services, and are naturally considered in an analysis of trade. Most policies, however, are primarily directed at domestic non-trade objectives; many of these policies also have important effects on trade. For example, health and safety regulations may restrict the import of or encourage the export of drugs, pesticides, or machinery which do not comply with the domestic regulations. Or, high wheat price supports may be used to encourage the adoption of new technology, but also encourage excessive imports of wheat which is likely to result in an additional trade restriction policy to prevent excessive imports. This section consists of three parts: 1) commodity policies with important linkages to trade, 2) trade policies, and 3) trade agreements.

Commodity Policies

There are two basic commodity policies used to support or encourage farm production: commodity price supports and input price or credit subsidies. A commodity price support policy in most countries establishes a floor or minimum guaranteed price. An input price or credit subsidy either reduces the cost of the input or reduces the cost of credit obtained for the purchase of agricultural inputs. The reasons for use of these policies differs, depending on whether the commodity is imported or exported.

In an importing country either commodity price supports or input-credit subsidies or both are usually used to encourage increased output. In the

European Economic Community (EEC) and Japan, income support and reduction of price variance are also objectives. While both policies are expected to increase output and reduce imports, only the price support policy, if the price support level is greater than the international trade price, is expected to generate the need for a more direct trade policy to control excessive imports.

Income support and reduction of price variance are general goals of price supports and input subsidies in exporting countries. Australia, Canada, and the U.S. are the major grain exporting countries with these objectives. Price supports are subject to production restrictions or quotas in most years. Newly emerging exporting countries such as Brazil and Argentina still retain goals of encouraging production. Since price support levels are nearly always above world prices in exporting countries, price supports usually result in more product to export but reduced demand for exports because of the higher support price.

In the U.S., agricultural policy since 1961 has consisted of price supports (loan ratio plus a supplemental subsidy to reach a target price) available to farmers who comply with "voluntary" diversion requirements to remove a minimum percent of cropland from production. In addition, the farm credit system has provided credit at subsidized interest rates, a subsidy which has essentially become nonexistent at present.

The EEC and Japan, as major importers of wheat, corn, and other grains, support grain prices at levels above international trade prices. In addition, durum wheat producers in regions of the EEC characterized by low yields receive a production subsidy. Japanese farmers receive subsidies for the diversion of rice paddy fields to wheat or barley because there is usually a surplus of rice.

Trade Policies

Tariffs (import taxes), export subsidies, and quotas are the policies which probably come to mind most frequently when discussing trade policy. However, use of these trade policy tools appears to be declining because of multi-lateral trade negotiations and, more importantly, the perceived need for more flexible policy tools since the breakdown of Bretton Woods in 1973. The most important tariff policy at present is probably the variable levy system of the EEC where the import tax is set such that the minimum commodity import price plus tax (variable levy) is equal to the support or target price of the commodity. Korea and Japan use a combination tariff-quota policy where a tariff is imposed when imports exceed a stipulated quota.

The most prominent trade policy or restriction at present is some form of direct state trading, i.e., where the national government or some appointed organization makes all export sales or import purchases. The wheat marketing boards of Australia and Canada are examples where exports are controlled by a single quasi-government unit. Brazil, Argentina and South Africa use a combination of export quotas or licenses, and taxes or subsidies to control exports.

A recent example of state import trading is the Russian wheat deal of 1972. State traders from the USSR simultaneously purchased grain from several companies and were able to obtain signed contracts before the market price of wheat responded to the increased demand. In addition to the centrally planned economies, Brazil, Korea, India, Japan and Mexico are other examples of countries where import purchases of one or more commodities are made exclusively by a governmentally sanctioned unit.

The growth of discretionary trade policies in the form of state trading, embargos, licensing and other administrative policies increases significantly the difficulty of predicting how exports or imports respond to price changes. With knowledge of domestic commodity supply and demand functions from which excess demand or supply functions can be derived, the estimation of the impacts of tariffs, export taxes and quotas is straightforward. However, very little is known about what state traders or other government administrators take into account in making export or import decisions.

Trade Agreements

There are two types of trade agreements: bilateral and multilateral. A bilateral trade agreement is an agreement between two countries for the purchase or exchange of specific commodities. The grain agreements between the U.S. and the USSR and the U.S. and the Republic of China are bilateral trade agreements. A bilateral agreement is relatively easy to obtain because only two countries are involved. It can be restrictive if the negotiated agreement isolates the negotiated commodities from market forces.

Multilateral agreements occur when three or more countries are involved. Because more countries are involved, multilateral agreements are much more difficult to negotiate. The two major multilateral trade organizations are GATT (General Agreement on Tariffs and Trade) and UNCTAD (United Nations Conference on Trade and Development). The GATT, established in 1948, is a forum where contracting parties work together for the liberalization of trade. Trade in agricultural products was initially excluded at the request of the U.S. The Kennedy Round (1964-67) was one of the better known negotiating conferences. The Reagan Administration asked for a new round of GATT negotations in 1985.

The UNCTAD was established in 1964 as a permanent organ of the General Assembly of the United Nations. The Conference normally meets every four years, while the Trade and Development Board meets annually. The aims of UNCTAD are 1) the promotion of international trade especially between developing countries and between countries with different economic and social organizations, 2) to formulate principles and policies on trade, 3) to review and coordinate activities of other UN institutions, and 4) to initiate action for negotiation and adoption of multilateral agreements. The GATT and UNCTAD jointly run an International Trade Center founded in 1964.

In addition to commodity and trade policies, agricultural trade depends upon the international exchange system and the financial flows across countries. In the next section, we discuss how the present international financial system evolved.

Evolution of the International Financial System

The international financial system has undergone major changes since 1970. These changes are an integral part of changes in international trade relationships. It is important to understand how financial linkages to macroeconomic policy have changed in the post-Bretton Woods era in order to understand the financial linkages to agricultural trade. In this section there are four parts: 1) The Bretton Woods Agreements, 2) Breakdown of the Bretton Woods System, 3) A Flexible/Managed-Float Exchange System, and 4) Price Adjustment with Flexible Exchange Rates.

The Bretton Woods Agreements

The Bretton Woods Agreements, established in 1944, were designed to tighten exchange controls over private capital movements. They were deve-

loped in response to volatile money flows during the pre World War II period. The World Bank and the International Monetary Fund (IMF) were originated in the agreements.

The World Bank was designed to finance economic development in two programs. The first program, supported by funds from capital markets of member countries, finances development projects at market rates of interest. The second, with funds contributed by donor countries, finance loans at concessionary rates.

The IMF was established to finance short-term adjustments to balance of payments problems. It originally had three objectives: 1) to monitor and advise on changes in exchange rates and exchange practices, 2) to borrow from/lend to member countries, and 3) to use its Special Drawing Rights (SDRs) to stabilize currency markets.

Under the Bretton Woods agreements, the so-called world dollar standard existed whereby the U.S. government maintained convertibility of the dollar into gold at $35 an ounce. The currencies of all other countries had fixed dollar parities (exchange rates). The heart of this fixed exchange rate system was the willingness of central banks to intervene in the foreign exchange market in order to keep their currencies within 0.75 percent of their dollar parities; the U.S. Federal Reserve typically did not intervene. In most cases, industrial countries adjusted their internal financial policies to preserve the exchange rate. Gold convertibility was viewed as essential in making the fixed exchange standard satisfactory.

Breakdown of the Bretton Woods System

It is not possible to attribute the breakdown of the Bretton Woods fixed exchange rate system to any particular factor. Begining in the 1960s,

several factors emerged which put growing pressure on the maintenance of fixed exchange rates. Two of the early factors were increased growth of the U.S. money supply (M1) in response to the Great Society programs and the Vietnam war, and the emergence of the Eurocurrency market in the mid 1960s due to U.S. banking controls. Both factors increased the difficulty of maintaining gold convertibility at $35 per ounce. Between 1969 and 1972, international reserves tripled while deposit bank foreign liabilities (a measure of international private bank credit outstanding) more than doubled. Growth of the world money supply (M1) rose above 11 percent in 1971 and has exceed this rate in every year through 1983. In sum, from 1960 onward there was growing pressure for a more flexible exchange system and reduced willingness by the U.S. to conduct the disciplined monetary policy required to maintain the fixed exchange system. The U.S. ceased gold convertibility and first devalued the dollar in late 1971; it then devalued the dollar again in early 1973 and floated it against other currencies. With continued devaluation pressure on the dollar, a new system was forced to emerge.

A Flexible/Managed-Float Exchange System

The exchange system which has emerged is a combination of floating exchange rates among the developed or industrial countries of Europe, Japan, Canada and the U.S., and fixed developing country currency to U.S. dollar exchange rates. Developing countries are free to revalue their currencies against the dollar at any time without approval of the IMF. As the system emerged through the 1970s, it could be characterized as a system of easy credit. Rapid world money growth continued as did expansion of international reserves and international credit fueled by recirculation of

petrodollars. Rapid world money growth has continued in the early 1980s, but U.S. money growth and international reserves and credit growth have slowed. Several developing countries have incurred major debt repayment problems as money growth rates of industrial countries were reduced and the days of easy credit ended.

Under the flexible system the dollar is no longer the only reserve currency; the currencies of most developed countries serve to some extent as reserve currencies. The multiplicity of reserve currencies has been accompanied by significantly increased substitutability among these currencies. As a result, and contrary to expectations that each country would be able to conduct monetary and fiscal policy independently of that in other countries, experience suggests that changes in monetary or fiscal policies in one country can generate large capital movements across one or more countries. For example, the recent relatively tight monetary policy of the U.S. Federal Reserve in combination with a deficit fiscal policy is credited with creating relatively high real interest rates in the U.S. and a high exchange value of the dollar, which in turn are responsible for net capital inflows and a large balance of trade deficit for the U.S.

The IMF has been forced into several new roles under the flexible exchange system. These roles include 1) lender of last resort, 2) counselor to delinquent debtor countries, and 3) coordinator in the rescheduling of delinquent loans. The volatility of the international financial system has led several economists to recommend the establishment of exchange controls, the establishment of limits on exchange rate fluctuations or the coordination of money supply growth across the major industrial countries.

Price Adjustment with Flexible Exchange Rates

Aside from transportation costs and import or export taxes, the price of any commodity, say wheat, in a country can be expressed in terms of another country's price, say the U.S., as

$$P_d = e\ P_{us}$$

where P_d is the domestic price of the given country, P_{us} is the U.S. price, and e is the exchange rate defined as the domestic currency units required to purchase one dollar. For example, it took about 250 Japanese yen or 3 German marks to purchase one dollar in 1984. As long as this relationship between domestic and other country (U.S.) general price levels is maintained, there is said to be purchasing power parity (PPP). Under PPP, a change in any variable generates an expected immediate adjustment in the remaining variables to reestablish the equality. When tariffs, quotas, marketing boards or other trade restrictions are used, PPP is usually violated.

Under the Bretton Woods fixed exchange rate system, the exchange rate was fixed or allowed to change only under highly controlled conditions. Under the fixed rate system, the relative prices of wheat or any other commodity between two countries were equal to the fixed or constant exchange rate

$$\frac{P_d}{P_{us}} = e^* = \text{constant}$$

Under the flexible/managed-float exchange system, e is variable between any two countries which allow their exchange rates to float. The U.S., Canada, Japan, Australia and the countries of Europe allow their exchange rates to float among each other, while many developing countries peg their exchange rates to the dollar. When e is variable then the relative prices of each commodity between any two countries must change as e changes for reasons which may

be totally unrelated to production or consumption of the commodity. For example, the trade weighted value of the dollar rose about 75 percent between 1980, its low, and 1984. This means that the ratio of P_w/P_{us} must have risen from say 1 to 1.75, where P_w is world price, if U.S. wheat was to maintain its competitive position in world markets. In other words, the change in e generated a world price increase of 75 percent relative to the U.S. price (or a 45 percent decrease in the U.S. price relative to the world price). Shown in Figure 3 is the linkage between the exchange value of the dollar and the index of prices received by U.S. farmers. Changes of this magnitude in exchange rates stimulate requests for trade restrictions by producers in the country whose exchange rate rises, in this case in the United States.

Export Linkages

In the previous sections, the reasons for trade, trade policies, and the evolution of the international financial system were discussed. In this section, the ways in which U.S. agriculture fits into the world food and fiber system is discussed. At the same time, an attempt is made to show how trade policies and the financial system affect behavior of the world food and fiber system. Five topics are addressed in this section: 1) world food demand, 2) world food supply, 3) export supply, 4) import demand for food, and 5) the demand for U.S. agricultural exports.

World Food Demand

The demand for food is affected primarily by relative food prices, real per capita income and population. The economic theory of demand implies that the quantity demanded of food increases as food prices decrease and as per capita income and population increase.

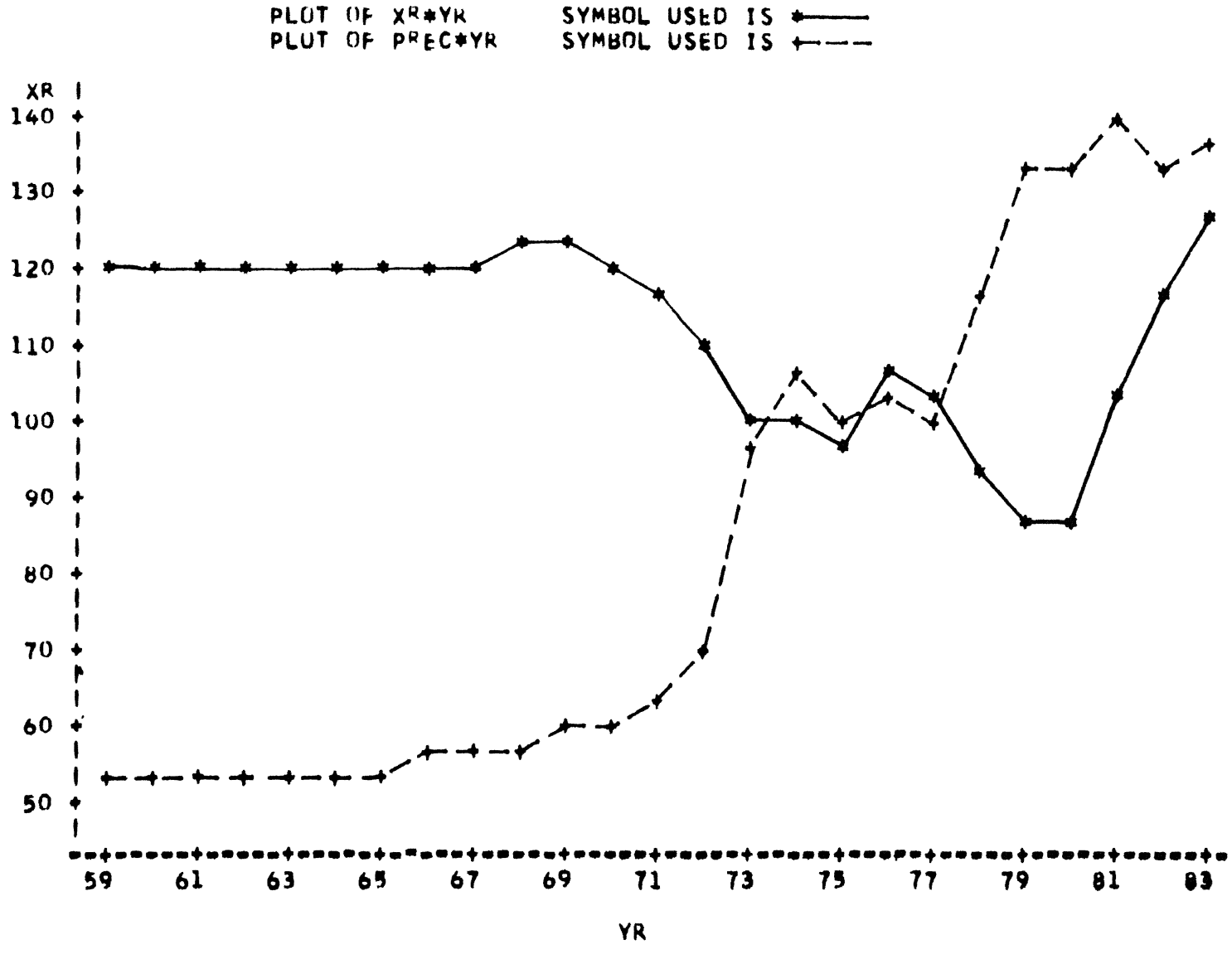


Figure 3. Exchange Rate (XR) by Prices Received by Farmers (PREC)

Food Consumption. World food consumption grew at an estimated 2.5 percent per year during 1960-80. Growth was faster in developing countries at 2.8 to 3.0 percent per year than in the developed countries at 2.2 to 2.4 percent. Per capita GNP growth was similar between developing and developed countries while population growth was higher in the developing countries than in the developed countries. The rate of growth of food consumption is expected to be less during 1980-2000 than during 1960-80 because of slower per capita income growth in the developing countries and of credit issues discussed in the macroeconomic linkages section below.

Income and Price Elasticities of Demand. While food consumption is expected to expand in proportion to population growth, the response to income and price changes is expected to be less than proportionate. The responsiveness of consumption to income or price is measured by an elasticity. The income (price) elasticity of demand is defined as the percent change in the quantity of food demanded when income (price) changes by one percent. The income elasticity is expected to be positive while the price elasticity is expected to be negative. When the elasticity has an absolute value of less than one, i.e., when quantity demanded changes less than proportionately to price or income, it is said to be inelastic. When greater than one, an elasticity is said to be elastic.

The income and price elasticities of demand for food products are generally inelastic, i.e., quantity demanded changes less than in proportion to income or price. There are no estimates of the "world" demand for food from which price and income elasticities can be obtained. What is available are elasticity estimates for individual countries or for groups of countries such as

EEC, centrally planned economies or subgroups of developing countries for specific food commodities or groups of commodities.

The largest number of price elasticity of demand estimates are for wheat and corn. Price elasticity estimates for wheat are smaller in absolute value for developed countries including the U.S., EEC, Canada, Australia and Japan than for in developing countries. For corn, price elasticity estimates are of larger magnitude in the developed countries, probably because of large use as feed for livestock which has a more elastic but still inelastic response.

There are very few estimates of income elasticities of demand. In general, it appears that the income elasticity of demand for food grains (grains for direct human consumption, such as wheat) is very close to zero in developed countries, i.e., an increase in income has no effect on consumption, while it is less than one-half in developing countries. Income elasticities for livestock products appear to be inelastic but larger than those for food grains, and perhaps as large as one in some developing countries.

In summary, the demand function for food products is characterized by price and income elasticities which are less than one in magnitude. These estimates imply that a relatively small increase in world output will be accompanied by a relatively large decrease in world price unless income or population increases to offset the implied price decrease.

World Food Supply

The world supply of food is affected primarily by two factors: food prices relative to input prices and weather. Higher food prices encourage farmers to invest in production capacity and increase output. Weather fluctuations tend to randomly affect food production, but weather impacts

are frequently large as compared to price and income changes.

Food Production. Food production grew at an estimated 2.5 to 2.6 percent per year during 1960-80, which is very similar to the rate of growth in food consumption. The rates of growth in the developing and the developed countries were similar. The rate of growth of food production during the 1970s was less than during the 1960s, with the largest decrease in rate of growth occurring in the developed countries. Projections to the year 2000 suggest slower food production growth during 1980-2000.

Price Elasticities of Supply. Large impacts of weather fluctuations on food production make it much more difficult to estimate food supply functions than demand functions. As a result, estimates of price elasticities are scarce. The price elasticity of supply is the percent change in quantity from a one percent change in price; it is expected to be positive. Some have suggested that the U.S. price elasticity of food supply is greater than one, i.e., elastic. Most evidence, however, suggests that short to medium run (one to five year) elasticites are less than one-half in the U.S. and in other countries.

The 1972 Food Crisis. In addition to changes in the international financial system which occurred in the 1965-73 period, the food system experienced some additional shocks. In 1972, world grain production decreased by about 6 percent, or 37 metric tons, from 1971. While this production shortfall in itself is not of crisis magnitude, it was accompanied by relatively low world stocks of grain. The U.S. in particular, the major holder of carryover grain stocks, had been very successful in reducing record levels of grain stocks held by government in 1960 to very low levels by 1970. At the same time,

in 1972 the Soviet government decided to make large wheat purchases to maintain growing demand for livestock products. This Russian wheat deal, described earlier, amounted to $963 million or one third of the increase in the value of U.S. grain exports for fiscal 1973.

Export supply

The export or excess supply function is the difference between quantity produced and quantity consumed at each price level (Figure 1). A country which exports an agricultural commodity probably has a comparative advantage in its production, i.e., at the world market price more is produced than is consumed. Since U.S. agricultural exports are concentrated in wheat, coarse grains and oilseeds, the trade discussion which follows is focused on these commodities.

Trade in Agricultural Commodities. The nominal value of world agricultural exports increased from $33 billion in 1960 to $233 billion in 1981 before declining (Table 1). This rapid growth of exports was dominated by inflation; the inflation-adjusted increases are 15 percent in 1960-72 and 41 percent over 1972-81. Also shown in Table 1 are wheat, coarse grains, and soybeans exports. Trade in each of these commodities, which are the dominant components of U.S. exports, grew more rapidly than total inflation-adjusted agricultural exports.

Also shown in Table 1 is the U.S. share of world agricultural exports. From 1973 to 1981, the U.S. share of total exports was in the 17-19 percent range. The U.S. has dominated the soybean market until recently and showed an increasing share of the coarse grains market through 1981. The year 1981 was an exceptionally high year for the U.S. market share of wheat.

Major Agricultural Exporters. In addition to the U.S., the major wheat exporting countries are Canada, Australia, Argentina, and France. Since 1960, these five countries have shipped 75 to 90 percent of wheat exports. The U.S. alone originates 30 to 40 percent of all wheat exports.

The major exporters of coarse grains since 1960 are the U.S., Canada, Australia, Argentina, Thailand and South Africa. These six countries have originated 65 to 90 percent of coarse grain exports. The U.S. share has been 40 to 60 percent of coarse grain exports. Brazil and the Republic of China have emerged as exporters of coarse grains in the early 1980s.

The U.S. is the dominant exporter of soybeans. Argentina and Brazil have also become significant producers of soybeans and compete with the U.S. in international oilseeds markets.

Table 1--World Agricultural exports, Total and Selected Commodities

Item	Total	Wheat	Coarse Grains	Soybeans
	Billion dollars	----Million metric tons----		
1960	33	44	26	4
1972	66	56	56	14
1981	233	99	104	26
Percent Change (Inflation Adjusted)				
1960-72	100(15)	27	115	250
1972-81	250(41)	77	86	86
Percent U.S. of World				
1960	15	41	42	100
1972	14	29	43	86
1981	18	49	68	85

Price Elasticities of Export Supply. The difficulty of estimating food supply functions extends to the estimation of export supply functions, since export supply is dependent on domestic supply. One study of the aggregate (all exporting countries) export supply of wheat and coarse grains estimates the aggregate price elasticity of export supply for wheat at 0.5 to 1.1 and for coarse grains at 2.0 to 5.4. The domestic elasticity estimates discussed earlier suggest that the export price elasticity is nearer the lower bound of these estimates.

Import Demand

The import or excess demand function is the difference between quantity consumed and quantity produced at each price level (Figure 2).

Major Agricultural Importers. Large importers of wheat, coarse grains and soybeans are much more diversified than large exporters. The importing developed countries (DC) include all of Europe except France and Japan. The import shares of these countries has declined for both wheat and coarse grains. For wheat, DC market shares declined from 28-40 percent during 1960-72 to 25-30 percent during 1972-81. The coarse grains market share declined more strongly from 70-83 percent during 1960-72 to 55-68 percent during 1972-83. The soybean share was 65 to 75 percent.

Both centrally planned (CP) and developing countries (LDC) increased market shares of coarse grains, CPs from 5-15 percent for 1960-72 to 15-25 percent for 1972-81 and LDCs from 6-14 percent to 13-22 percent. The CP share of wheat is usually 20-25 percent with no trend while the LDC share increased from 40-45 percent to 45-50 between 1960-72 and 1972-81. Soybean shares are less than 10 percent for CPs and 20-25 percent for LDCs.

Price and Income Elasticities of Import Demand. Import or excess demand was defined earlier as quantity demanded less quantity supplied at each price. As with export supply, import demand functions are also dependent on domestic supply functions. However, estimation problems are not as difficult since the domestic demand function is relatively more important to import demand (in importing countries). One approach is to assume that supply is exogeneous, i.e., that quantity supplied does not respond to price. Under this assumption, lower bound price and income elasticities of the import demand function can be derived from the domestic demand function.

Of greater concern is the impact of non-tariff trade barriers on estimates of price and income elasticities. The impacts of tariffs, export subsidies and quotas can be predicted because the impacts of these constraints on import demand can be defined and measured. However, discretionary trade variables such as state trading boards, licensing or embargoes are difficult-to-impossible to define and incorporate into estimates of import demand functions. What is probably being estimated in countries with non-tariff restrictions are the price and income elasticities of government policy makers or trade officials rather than of consumers.

With these problems in mind, price and income elasticities of import demand are discussed. Most estimates are for wheat and coarse grains. Estimates of the price elasticity of the world import demand for wheat are between one-half and two in magnitude. Estimates for both DCs and LDCs are inelastic, i.e., less than one in magnitude. However, the price elasticity estimates for the CP countries (or state trading boards) are greater than one in absolute value. The relative magnitudes of the income elasticities appear to be similar. The DC and LDC estimates are less than one (inelastic) while

the CP estimate is highly elastic. The relatively high elasticities for the CP economies may reflect the use of wheat as a livestock feed in these countries.

The relative values of the price and income elasticities for coarse grains are similar to wheat for the three groups of countries. The magnitudes are larger, i.e., more elastic, which reflects the greater expected use of coarse grains for livestock feed, where price and income elasticities of demand for meat are expected to be larger than for direct consumption of grain.

Demand for U.S. Agricultural Exports

In this section, the U.S. as a single exporting country to the world market is discussed. The trend of U.S. agricultural exports is shown in Figure 4. The primary issue is how import demand translates into demand for U.S. agricultural products, namely wheat, coarse grains, and soybeans. Under competitive market conditions, the U.S. could sell all it wanted at the world price. However, since there are few large exporting countries for any commodity and the U.S. is the largest and often dominant exporter, competitive market conditions do not exist.

Further, since the U.S. has historically maintained minimum support prices to producers on several commodities, including wheat and corn, it is asserted by some that the U.S. has been a residual supplier of commodities to the world market. The logic is that the maintenance of world prices at above equilibrium levels by the U.S. (the largest exporter) encourages other countries to increase production capacity and then undersell the U.S. in world markets. In this subsection, the translation of world import demand

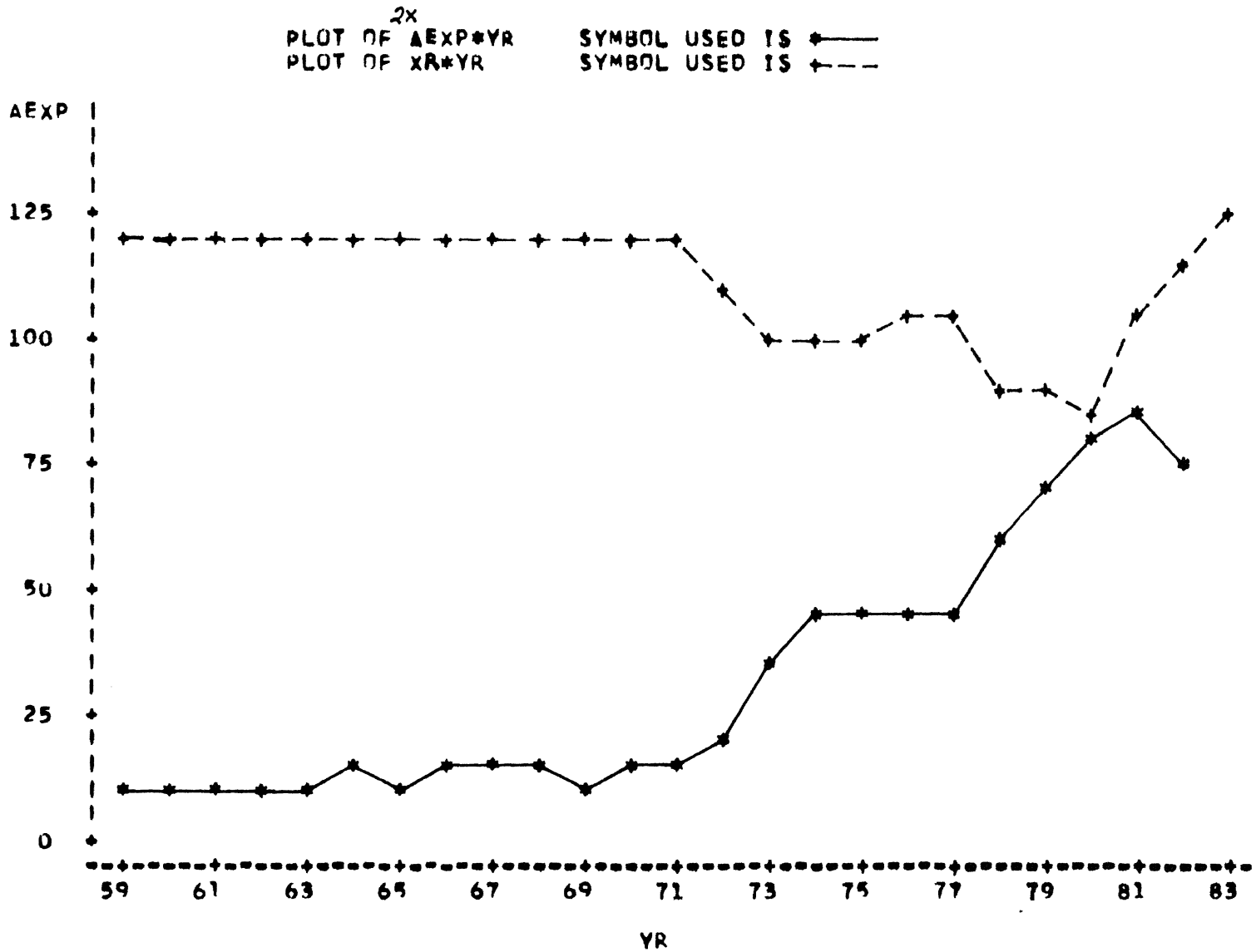


Figure 4. Agricultural Exports (AEXP) by Exchange Rate (XR)

into U.S. export demand is discussed under conditions of the Bretton Woods and the flexible/managed float systems. Then empirical estimates of the price elasticity of demand for U.S. exports are discussed, followed by a discussion of the residual supplier model.

Export Demand Under Bretton Woods. As long as the major industrial countries maintain balanced budget fiscal policies and limit monetary growth, the fixed exchange rate financial system can exist. As discussed earlier, as long as the exchange rate between two countries remains fixed, the relative price of any commodity between the countries is affected only by changes in demand or supply conditions for the commodity.

The strength of the fixed exchange system is its stability. Each country has relatively certain knowledge of its position in world markets. Through knowledge of its exchange rates with other countries and of its fiscal and monetary policy position, each country can establish stable trade linkages to other countries. Its long run supply functions relative to those of other countries are subject only to changes in technology. With respect to food production and consumption, the major short run uncertainty is weather impacts on output.

Export Demand Under Flexible Exchange Rates. With flexible exchange rates, the constraint which stabilizes relative prices between countries is released. Flexible exchange rates were expected to allow faster adjustment to external disequilibrium between countries, allowing equilibrium to be reestablished more quickly. The expected advantage of the system was that trade relationships between countries would be allowed to remain in equilibrium without constraining fiscal and monetary policies of individual countries. When a country changed its policy or exogenous

shocks occurred, the exchange rate would adjust and reestablish equilibrium.

However, the flexible exchange system which has emerged since 1973 has not fulfilled these expectations. The exchange rate has not responded neutrally to the fiscal and monetary policies of individual countries. Rather it has emerged to reflect the fiscal and monetary policy status of each country more than the balance of payments position. The exchange rate changes for reasons unrelated to relative prices or production costs across countries i.e., it is more strongly affected by capital flows across countries. The linkages of the exchange rate to monetary and fiscal policies were discussed more fully in the earlier section on macro policy linkages. These problems have led several economists to call for the reestablishment of monetary and fiscal coordination and discipline across countries, especially by the developed or industrial countries.

There appears to be a direct linkage between exchange rate changes and U.S. agricultural exports. The two periods over which the exchange value of the dollar fell (1971-73 and 1977-79) correspond with surges in prices received by U.S. farmers (Figure 3) and of exports (Figure 4). These periods also correspond with rapidly rising world nominal income, easy credit and relatively low world food stocks (reserves). Farmers in the U.S. responded rapidly and the U.S. was able to take advantage of a large world demand before other countries increased production capacity. After 1981, the exchange value of the dollar started rising, world nominal income growth declined (real per capita income growth was negative), credit was tightened and other countries had built new food production capacity. The essence of this instability was that the U.S. had gone from having a perhaps excessively strong competitive advantage in the production of

wheat, corn, and soybeans in the 1970s to a much weaker competitive advantage or even a competitive disadvantage in the 1980s for reasons which have no relationship to relative production costs, i.e., to comparative advantage.

Price Elasticity of Demand for U.S. Exports. The price elasticity of demand for U.S. exports is expected to be negative and relatively large in magnitude. Even in a large country such as the U.S., a relatively large response of quantity demanded to price is expected because the importing country can purchase the commodity from other sources if the exporting country raises its price. Recent evidence, however, suggests that the price elasticities of demand for U.S. exports of wheat, corn, and soybeans are no larger than the import demand elasticities of importing countries which were discussed earlier. This result is suggestive of the importance of discretionary trade restrictions and bilateral trade agreements in international markets for agricultural commodities.

Exchange rate elasticities have also been estimated for exports and prices of wheat, corn, and soybeans. The exchange rate elasticity of exports (price) is the percent change in exports (price) from a one percent change in the exchange value of the dollar. Both elasticities are expected to be negative, i.e., an increase in the value of the dollar is expected to reduce exports and prices. Under conditions of free trade, the exchange rate elasticity of exports is the same as the price elasticity of exports, i.e., an exchange rate change is the same as a price change. The estimated exchange rate elasticity of exports is greater than one in magnitude for wheat and corn exports, but less than one for soybeans. The exchange rate elasticity of price is greater than one in magnitude for

the three commodities, i.e., a one percent increase in the value of the dollar leads to a greater than one percent decrease in wheat, corn, and soybean prices.

The Residual Supplier Model. The residual supplier model applies to a market where there is one dominant producer and a large number of small producers. The market share of the small producers is not expected to respond significantly to price manipulation by the dominant firm, i.e., a higher than competitive equilibrium price is not expected to attract many new firms nor induce existing firms to expand output. Under these conditions, the dominant firm faces an excess demand curve similar to Figure 2. It can determine a monopoly price and output based on that excess demand curve, and allow the small producers to supply all they want at that price. The price set by the dominant firm must be less than P_0 in figure 2 or the small firms would supply total quantity demanded. If the dominant firm miscalculates and new firms or firm expansions are stimulated, the dominant firm loses market share.

Throughout the 1950s and 1960s and again in the 1980s, the U.S. has had price supports, for wheat and corn in particular, which have been greater than or equal to world prices. The U.S. has also been the largest producer and exporter of these commodities since World War II. With the exception of those periods when the U.S. has subsidized exports of agricultural commodities, the support price has either maintained world prices at the U.S. support level or has at least caused them to remain above market clearing levels because U.S. produced commodities were not released to export markets at prices below the U.S. price support level. While no one asserts that the U.S. has acted intentionally as a dominant firm to maximize

monopoly profits, the nature of the the U.S. price support policy has the characterisitics of a residual supplier firm which has miscalculated, i.e., the support price has not been adjusted sufficiently to stop the loss of U.S. export market share.

Import Linkages

Food products and farm inputs are imported to the U.S. as well as exported. In this section, imports of food products and of energy, an important farm input, are examined.

Food Imports

Agriculture in the U.S. can operate more efficiently if some food products are imported and agricultural resources are freed to produce outputs for which the U.S. has a comparative advantage. For example, tropical products such as cocoa and bananas could only be produced in the U.S. at high costs, perhaps confined to greenhouses. Consumers in the U.S. are better off importing cocoa and bananas from countries which have appropriate climates and exporting some other food product or good in payment for the imports. As indicated earlier, U.S. food imports are concentrated in the animal products and tropical products categories.

Food imports into the U.S. have grown more slowly than U.S. agricultural exports, both before and after 1972. In part, this is because of very low income elasticities of demand for all foods by U.S. consumers. The income elasticities for coffee, sugar, fruits and vegetables are each probably less than 0.2. Several specific fruits and vegetables appear to have income elasticities in excess of one, e.g., oranges, tomatoes, and beans, but in aggregate the income elasticity of demand is very low. The

price elasticities of demand for these foods are also very low at zero to -0.2. Similarly to the income elasticities, the price elasticities of several specific fruits and vegetables exceed one in magnitude because of high substitution among products, but the price elasticities of the aggregated product groups (fruits, vegetables) are very small. The price and income elasticities of demand for animal products are larger in magnitude, ranging from .3 to .5 in absolute value.

This relatively slow and stable growth in demand for food products imported into the U.S. is consistent with the relatively stable growth of the demand for food in the U.S. discussed earlier. Compared to the rest of the world, U.S. consumers do not make large changes in food consumption behavior even when faced with rather large changes in food prices and income.

Energy Imports

Farm inputs are not very dependent on international markets with the exception of energy. The U.S. has historically imported and continues to import a significant proportion of energy consumption needs. Energy prices rose significantly in 1974-75 and again in 1979-80 with rationing in 1973 and 1978. These were years when the exchange value of the dollar was low. In contrast, U.S. energy prices have declined since 1981 as the exchange rate has risen. Since crude oil prices are quoted in dollars, a change in the exchange value of the dollar changes oil prices in all countries with floating exchange rates. During the 1970s when the value of the dollar was low, energy prices in the U.S. were high relative to other countries. Since 1981, energy prices in the U.S. have fallen relative to prices in

other countries. One expected cost of a lower exchange value of the dollar is higher energy prices.

Linkages to Macro Policy Variables

In this final section on international trade linkages, the linkages between agricultural trade and the macro economy are discussed. Governments can finance expenditures in three ways: taxation, "printing" money, and selling bonds (running a deficit). In the U.S., only the Federal government is authorized to print money. Nearly all government units (state, county, municipal, etc.) are authorized to levy taxes and sell bonds. When tax revenues are sufficient to cover expenditures, the budget is balanced. The focus in this section is on situations where the Federal budget is in deficit, i.e., tax revenues are less than expenditures, and resort to money or bond finance is made.

The exchange rate is considered as one of the monetary variables, and thus far is the only macro variable linkage which has been discussed. However, in the international financial system which has emerged since 1972, the exchange rate is not a policy or control variable, i.e., it cannot be changed administratively. The exchange rate can only be changed through the manipulation of other variables which can be controlled. Linkages of the exchange rate and agricultural exports and prices to two monetary variables (money supply, interest rates) and two fiscal variables (U.S. Federal budget deficit, world credit outstanding) are explored in this section.

Effects of a Change in Money

There are two types of monetary policies which need to be discussed: 1) a one-time change in money supply and 2) a change in the rate of growth

in the money supply. The ways in which the money supply can be changed were discussed earlier. A one-time increase in the supply of U.S dollars means that people who hold dollars in total have more dollars after than before the increase. If people were satisfied with the quantity of dollars they held before the change, i.e., were in equilibrium, then after the increase they have more dollars than they want. This will lead holders of dollars to try to exchange some of their dollars for other things. What other things?

As indicated earlier, money has two uses to people: 1) it is a store of value or asset and 2) it facilitates exchange of goods and services. Research shows that when people have more or fewer units of money than they desire, they will first attempt to trade for other stores of value before making adjustments in trade for goods and services. Alternative assets to the U.S. dollar include other currencies (pounds, marks, yen, etc.), commodities (gold, silver, oil, wheat, corn) or bonds (private and government securities).

With too many dollars, dollar holders begin to exchange dollars for marks, yen, gold, wheat, treasury bills, etc. That is, they begin to bid up the dollar prices of other stores of value. This has the initial effect of raising the exchange value of other currencies with the dollar (reducing the exchange value of the dollar), raising commodity prices, and raising bond prices. Since most activity is initially concentrated on assets, the prices of stores of value are likely to initially increase more than proportionally to the change in money supply; this is called overshooting. As adjustments are extended to goods and services (consumer goods), all prices are expected to increase in proportion to the one-time

increase in money supply. This proportionality is called the neutrality of money.

The initial effect of the increase in the money supply on the interest rate is to reduce it. With excess currency, holders of dollars are willing to accept a lower rate of return on other stores of value. This occurs most obviously through the bidding up of bond or fixed value security prices, which lowers the rate of return on bonds. Initially, the interest rate fall will overshoot its new equilibrium level as most activity is focused on assets. As the adjustment in consumer goods markets occurs, the interest rate will increase from its low. At the new equilibrium the dollar prices of assets and consumer goods will be higher and the U.S. interest rate lower because there are more U.S. dollars relative to other assets and consumer goods after the one-time increase in money supply.

In most cases, a country does not make one-time changes in the money supply, but rather a decision to change the rate of growth of the money supply over time. For example, in 1979 the U.S. Federal Reserve made a policy change which reduced the rate of growth of U.S. dollars; the new policy changed the target variable from interest rate to money growth directly. The case is considered where the U.S. increases the rate of growth of money by one percentage point, say from 3 to 4 percent per year. Since this change can in part be considered as a series of one-time changes, the discussion of the one-time increase in money growth applies to this case.

In the case of a change in the rate of growth of the money supply, however, there are further effects. In the case of the one-time change, people expect no further increases in the quantity of dollars. When the money supply is growing continuously from year to year and a decision is

made to increase the rate of growth, holders of dollars are likely to expect that policy change to persist indefinitely. Here, the case of where people fully expect the policy change to be permanent is discussed, i.e., their beliefs are changed from expecting the U.S. money supply to grow at 3 percent per year to 4 percent per year. The money supply of other countries is also growing at 3 percent per year and is not expected to change.

Before the policy change there are already two important differences between this case and the previous case where no growth in money was occurring. First, since the money supply is increasing relative to commodities, bonds and consumer goods, the prices of these assets and goods are increasing at approximately 3 percent per year, abstracting from income and production growth effects. This 3 percent per year is called the inflation rate. Second, there is now a divergence between real and nominal interest rates,

$$r_{nominal} = r_{real} + r_{inflation}$$

where the nominal interest rate, i.e., that rate earned on bonds (treasury bills, etc.) is composed of the real rate (the inflation adjusted return) and the inflation rate. For example, a 5 percent bond with a 100 year maturity which sells at par ($1,000) with a zero rate of inflation would have an expected price of about $625 with a 3 percent rate of inflation to yield an 8 percent nominal interest rate.

With the increase to 4 percent in the growth rate of U.S. dollars, holders of dollars desire to shift from dollars to other things. Initial shifts are expected to be concentrated on other assets leading to an increased relative rate of growth in asset prices (other currencies,

commodities and bonds). This increase will lower the real interest rate (and probably the nominal rate) in the early phases of adjustment. As the rate of price growth on consumer goods increases from 3 to 4 percent, the rate of inflation increases to 4 percent, which raises the nominal interest rate (equal to the real rate plus the inflation rate) to a level higher than before the policy change.

In both cases, an increase in U.S. money relative to other currencies is expected to reduce the exchange value of the dollar and reduce the real interest rate, while the nominal interest rate increases if the increase in money supply is continuing over time. The reduced exchange value of the dollar improves the export advantage of U.S. products while the lower real interest rate reduces production costs. In the short run, there is excessive price incentive on agricultural commodities because of overshooting. In the cases of a decrease in money supply or a decrease in the rate of growth of the money supply, e.g., from 4 to 3 percent; all effects will be in the reverse direction to those discussed here.

Effects of Bond Financing

The financing of fiscal deficits through increased money supply was discussed in the previous section. In this section, the financing of the U.S. fiscal deficit through the sale of government securities (treasury bills, savings bonds, etc.) is discussed. It is assumed that money acquired from the sale of government securities is used to cover government expenditures, and that there is no effect on the supply of money.

The issuing of government securities represents an increase in the supply or number of interest bearing bonds in existence. If the government is to sell these bonds, it must do so at an interest rate which

attracts dollars from other uses. As with changes in money supply, the early responses are likely to be concentrated in asset markets. Since there are a fixed number of dollars with which to finance assets and consumer goods, the issuance of government securities is expected to first increase the real interest rate and the exchange value of the dollar. The increase in the real interest rate generates an expected fall in other asset prices (non-dollar currencies, commodities, and bonds). The exchange value of the dollar is expected to increase. As the adjustments are completed in the consumer goods markets, some lowering of prices of consumer goods is expected.

These effects of bond financing and no money growth are the opposite of money financing, leading to the opposite trade effects, i.e., lower exports, lower commodity prices and higher exchange values of the dollar with other currencies. If the budget deficit is not large, a government can finance some of its expenditures with bonds for long periods of time without major impacts on interest rates or the exchange rate. One measure of the debt burden is the ratio of debt to GNP. In the U.S. this ratio fell between 1960 and 1980, although there was only one year in which there was a Federal government surplus. Since 1980, this ratio has risen rapidly indicating that the U.S. Federal debt is a growing burden on the U.S. economy. One recent indication of burden is that interest on the Federal debt is becoming an ever larger part of the U.S. fiscal budget.

Joint Effects of Money and Bond Financing

The rate of growth of the U.S. money supply as measured by M1 first went to 5 percent in 1964 during the Korean War, then to 8 percent in 1967, to 9 percent in 1972 and held at 8 percent during 1977-79 (Figure 7).

Throughout this period of relatively easy money, the exchange value of the dollar was on a downward trend, i.e., the dollar value of other currencies was increasing. Commodity prices, for agricultural products and for oil in particular, showed strong upward trends. Nominal interest rates were high because of relatively high rates of inflation. At many points in time until 1980, however, real interest rates were negative, i.e., the rate of inflation exceeded the nominal interest rate. Throughout this period, real interest rates were low. Low to negtive real interest rates occurred because in several years actual inflation rates exceeded those anticipated by dollar holders.

In 1979, the Federal Reserve changed its target from the interest rate to money growth directly, which resulted in reduced rates of money growth. Shortly thereafter, the Reagan administration began running large budget deficits. After declining from 60 percent in 1960, the ratio of debt to gross national product increased from 34 percent in 1981 to 42 percent in 1983 (Figure 5). The exchange value of the dollar began increasing after 1980, while commodity prices stated in dollars began to fall.

Effects of International Debt

A final topic examined in this section is the effect of international debt. The level of borrowed funds held throughout the world began increasing very rapidly about 1968, and then slowed dramatically about 1982. These changes lag changes in U.S. monetary policy by about 3 years. First, the Great Society and Viet Nam War monetary expansion of 1964 and the following easy money policy was accompanied by the recirculation of the so-called petrodollars after 1973. However, faster monetary expansion had been underway for about 8 years before the OPEC oil crisis. Then the Federal

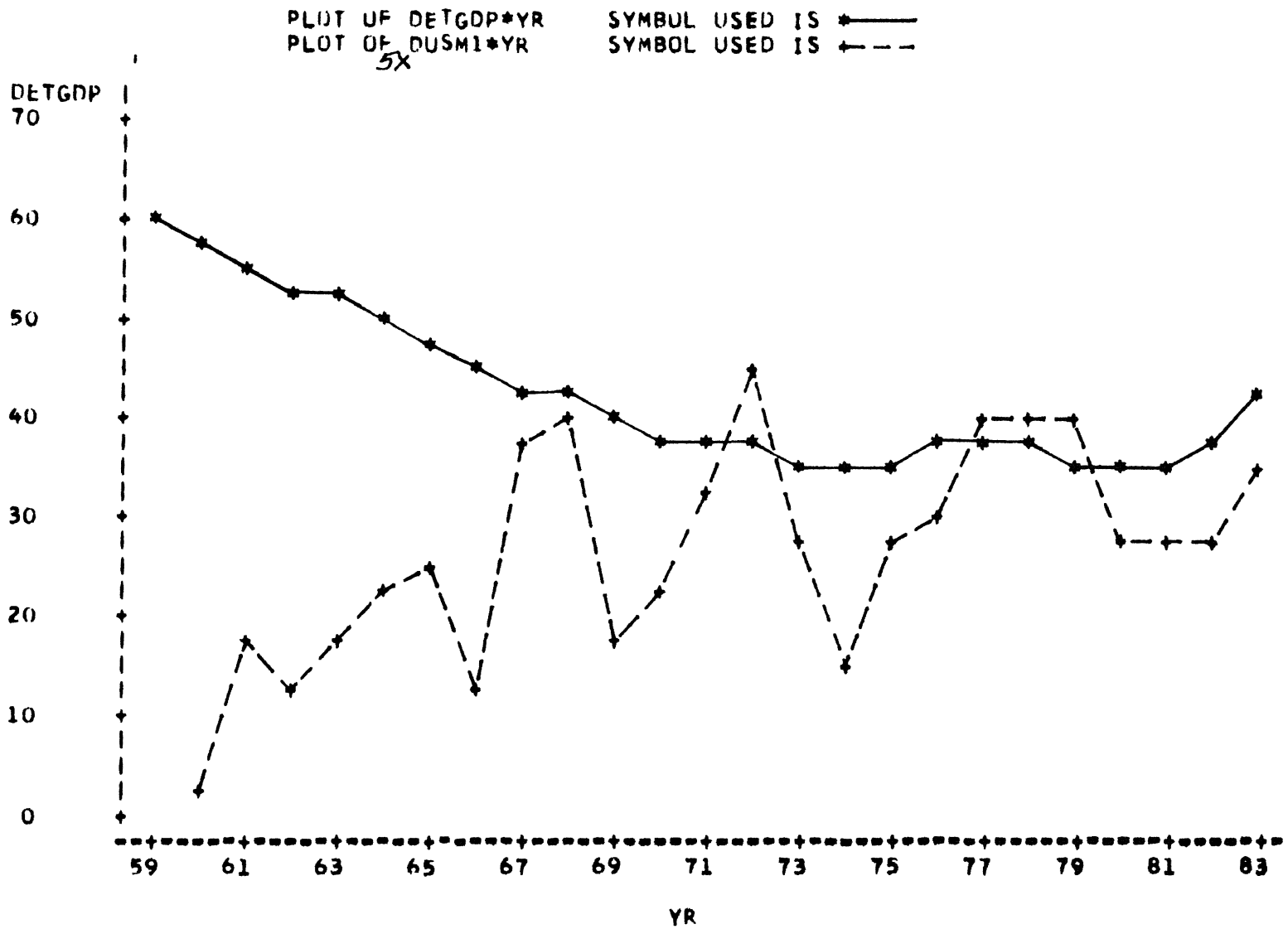


Figure 5. Ratio of Debt to GDP (DETGDP) by Change in Money Supply (DUSM1)

Reserve target change in 1979 preceded the slowdown in credit expansion after 1982 by three years. The slowdown of world debt growth also corresponds to the increased rate of debt accumulation by the U.S.

The rapid expansion of world debt probably contributed strongly to the high growth in nominal world gross domestic product after 1972. However, it may also have contributed to lower real gross domestic product growth after 1972 as contrasted to before 1972.

Over 60 percent of international debt is held by important export markets for U.S. agricultural products. These debtor countries need to be able to export their products in order to generate the international reserves needed to pay off loan commitments. These are loan commitments which were made during the 1970s under an easy or cheap money policy when the exchange value of the dollar was low. Now these countries are faced with repaying these loans in a tight money framework where the exchange value of the dollar and real interest rates are near record highs.